AMENDMENTS TO THE SPECIFICATION

[0009] The presence of a capacitor, and the size of any capacitor employed, is determined based on the color response of the pixel to which the capacitor is connected. Generally, the capacitors fall within the range of 1-50 femtofarads (10^{-15} farads). In an RGB color pixel arrangement, for example, most preferably, red pixels will utilize the smallest capacitors, about 0-20 femtofarads, green pixels will utilize a middle range, about 2-20 femtofarads, and blue pixels will utilize the largest capacitors, about 3-20 femtofarads. The capacitors are sized in relation to the electron production of each colored pixel. Red pixels produce the fewest electrons, and therefore have the smallest, or no, capacitor. Blue pixels produce the most electrons, and therefore have the largest capacitor. Green pixels produce electrons in an amount between red and blue. Sizing the capacitor in relation ~~on~~ to electron production allows a greater percentage of each capacitor to be utilized. By employing capacitors sized in relation to the electron production of each color pixel, the sensitivity of each pixel circuit is increased.

[0024] Referring now to the drawings, where like elements are designated by like reference numerals, Fig. 1 illustrates a first exemplary embodiment of the invention. A pixel sensor cell 100 is illustrated having a storage capacitor 199 overlying a field oxide region, and electrically connected to a floating diffusion region 130 and to ground. As explained in more detail below, storage capacitor 199 is formed so that it does not block any light sensitive areas of the imager. In addition, storage capacitor 199 is formed overlying the field oxide region ~~115~~ entirely, without blocking the floating diffusion region 130. Alternatively, however, the storage capacitor 199 also may be formed entirely over the active pixel area, or only partially over the field oxide area and partially over the active area, as desired.

[0025] It should be noted that, although the invention will be described below largely in connection with use in a four-transistor (4T) pixel cell which is depicted in Fig. 1, the invention also has applicability to a three-transistor (3T) cell as well as other

configurations. The 3T ~~cells~~ cell differs from the 4T cell in the omission of a charge transfer transistor, as described further below.

[0026] Referring to Figure 1, the storage capacitor 199 is electrically connected between floating diffusion region 130 and ground. Alternatively, capacitor 199 can be connected between floating diffusion region 130 and a voltage source. The four transistors illustrated in Figure 1 can be identified by their gates, as follows: transfer transistor gate 128, reset transistor gate 132, source follower transistor gate 136 and row select transistor gate 138. In the arrangement shown in Fig. 1, storage capacitor 199 amplifies signals collected by a photo diode 125.

[0029] The structure of a pixel cell 200 of a second embodiment of the present invention is illustrated with reference to Figure 2. It should be understood that similar reference numbers correspond to similar elements as previously described with reference to Figure 1. The structure of Figure 2 differs from the above-described embodiment in that storage capacitor 299 is formed in contact with the photodiode 125 and not with the floating diffusion region 130, as in the previous embodiment. Processing of the second embodiment is similar to the processing used to produce the previous embodiment, except that a metal contact is formed that connects an electrode of the storage capacitor 299 to a doped transfer region of the photodiode, and not to the floating diffusion region 130, as in the above-described embodiment. Again, the storage capacitor 299 may be formed entirely or only partially over the field oxide region ~~115,~~ as well as entirely or only partially over the active area of the pixel sensor cell. If the storage capacitor 299 is formed entirely over the field oxide region ~~115~~, the advantage is that the storage capacitor 299 improves the charge storage capacity of the imager without reducing the size of the photosensitive area.

[0031] Figure 3 illustrates yet another embodiment of the present invention according to which two different storage capacitors are connected to two different elements of pixel sensor cell 300. For example, Figure 3 depicts storage capacitor 399a, which is connected to the photodiode 125, and storage capacitor 399b, which is connected

to the floating diffusion region 130. Both storage capacitors 399a, 399b of pixel sensor cell 300 (Figure 3) may be formed totally overlying the field oxide region ~~115~~, without reducing the photosensitive area of the pixel cell, or only partially over the field oxide region ~~115~~. Storage capacitors 399a, 399b of pixel sensor cell 300 also may be formed totally overlying the photosensitive area of the pixel cell, or only partially over the active area.

[0033] The processing for the formation of the storage capacitors 399a, 399b of pixel sensor cell 300 of Figure 3 are similar to the processing steps for the embodiment described above, except that two capacitors (and not one capacitor) are formed over the field oxide region. In addition, contact 346 (Figure 3) and contact 347 (Figure 3) connect each of the lower electrodes of the storage capacitors 399a, 399b to the doped transfer region ~~126~~ and to the floating diffusion region 130, respectively. Preferably, contacts 346, 347 are formed of a conductive material, such as doped polysilicon, or a metal such as titanium/titanium nitride/tungsten. Photolithographic techniques are used to define the areas to be etched out to form the holes for the contacts 346, 347 wherein the conductive material is subsequently depositing therein.

[0035] Figures 4-6 illustrate additional embodiments of the present invention, according to which a storage capacitor is connected not to a ground source, as in the previous embodiments, but rather to a gate of one of the four transistors of the 4T cell. For example, Figure 4 illustrates storage capacitor 499 formed entirely or partially over the field oxide region ~~115~~, and connected to both the photodiode 125 and to the gate stack 127 of transfer transistor 128. In another exemplary embodiment, Figure 5 depicts storage capacitor 599 formed over the field oxide region ~~115~~ and also connected to both the floating diffusion region 130 and to the gate stack 127 of transfer transistor 128. According to yet another exemplary embodiment, storage capacitor 699 of Figure 6 is formed over the field oxide region ~~115~~ and is further connected to both the floating diffusion region 130 and to a gate of reset transistor ~~136~~ <u>132</u>.